

COMPOSITION AND DIGESTIBLE NUTRIENT CONTENT OF NAPIER GRASS LEAVES¹

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INTRODUCTION

Napier grass (*Pennisetum purpureum* Schum.), also known as elephant grass and Merker grass, is a rank-growing perennial which is being used extensively for rotational pastures, as silage, and as a soil-improving crop, in Florida, Hawaii (10, 11),³ Trinidad (8, 9), and other tropical and semitropical regions. This paper reports the results of a study to determine the composition and digestible nutrients of leaves of Napier grass harvested in a way to simulate grazing by cattle.

REVIEW OF LITERATURE

No analyses of Napier grass leaves or of that part of the plant consumed by cattle in natural grazing have been found in the literature. Wilsie, Akamine, and Takahashi (10) reported the composition of the "palatable portion" of the plant harvested at varying growth intervals which they designated as "all leaves and that part of the plant above and including the fifth visible ligule from the tip of the culm." Paterson (8, 9) reported the composition of two varieties, for the entire plant, harvested at short intervals.

Harrison (4) conducted digestion trials with fresh Napier grass and found the digestion coefficients to be: For crude protein 63, for crude fiber 64, for nitrogen-free extract 60, and for crude fat 57. The chemical composition and digestibility of Napier grass as reported in the literature are summarized in table 1.

The digestion coefficients for Napier grass silage were determined by Neal, Becker, and Arnold (7) to be: For crude protein 29, for crude fiber 50, for nitrogen-free extract 40, and for crude fat 65. Digestibility experiments have been reported on Napier grass by Carbery, Chatterjee, and Talapatra (2), but as theirs was a study of mineral balances no digestion coefficients were included in the report.

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³ Italic numbers in parentheses refer to Literature Cited, p. 92.

EXPERIMENTAL METHODS

The digestion trial, carried out at Gainesville, Fla., was conducted according to the method outlined by Forbes and Grindley (3). The Napier grass consisted of the leaves with the tender-growth tips plucked by hand twice daily in a manner to simulate grazing, from plots representing the growth of the preceding 4 weeks, the plots having been harvested in the same manner at that time. This freshly cut Napier grass constituted the entire nutrient intake of four mature Jersey steers for 4 consecutive 5-day experimental periods, following a 10-day preliminary feeding period. The feces were collected manually and stored in galvanized-iron cans. Samples were taken daily for dry-matter analyses and in triplicate for nitrogen determinations on the fresh material. Dry-matter samples were composited by 5-day periods for proximate analyses.

TABLE 1.—Composition and digestibility of Napier grass as reported by several investigators

WILSIE, AKAMINE, AND TAKAHASHI (10)

Growth period (weeks)	Digestion trial No.	Composition on dry basis						Total digestible nutrients
		Dry matter	Crude protein	Crude fiber	Nitrogen free extract	Crude fat	Ash	
		Percent	Percent	Percent	Percent	Percent	Percent	Percent
6			7.9	28.8	41.9	2.2	19.2	
8			6.9	36.7	41.2	2.0	19.2	
10			6.0	32.0	42.5	1.9	17.6	
12			5.9	32.6	42.4	2.0	17.1	
14			5.6	33.9	43.1	2.0	15.4	

PATERSON (8)

4		14.5	9.9	24.0	147.3		18.8	
8		16.5	7.4	27.4	148.4		16.8	
12		20.7	6.1	31.5	145.7		16.7	

PATERSON (9)

2		13.3	11.7					
4		13.7	9.8					
6		13.3	7.5					
2		12.2	11.9					
4		12.8	9.2					
6		14.8	7.5					

HARRISON (4), ON FRESH BASIS²

I		16.7	1.3	4.9	7.8	0.3	2.4	
II		17.3	1.9	5.1	8.4	.2		
III		19.8	1.5	6.9	8.3	.4	2.7	

HARRISON (4), DIGESTION COEFFICIENTS

I			64.0	62.0	61.0	45.0		
II			65.0	58.9	54.2	66.6		
III			60.2	71.6	64.2	60.2		

HARRISON (4), DIGESTIBLE NUTRIENTS

I			0.8	3.0	4.8	0.1		8.7
II			1.2	3.0	4.6	.1		9.0
III			.9	4.9	5.3	.2		11.3

¹ Includes crude fat.

² Harrison presented original data on fresh basis.

In separate investigations at the Florida Agricultural Experiment Station by Blaser, Kirk, and Arnold to evaluate Napier grass under rotational grazing with beef and dairy cattle, samples were plucked at regular intervals from protected quadrats in a manner to simulate grazing in the remainder of the field. These quadrats were moved at regular intervals. The harvested material was used to represent the composition of the grass as grazed. Proximate analyses were made by methods of the Association of Official Agricultural Chemists (1). Calcium, magnesium, and phosphorus were determined by the method of Morris, Nelson, and Palmer (5).

RESULTS OF EXPERIMENTS

The composition of the Napier grass as used in the digestion trials, and from the separate grazing tests conducted by Blaser, Kirk, and Arnold for a 2-year period, are presented in table 2. The ranges among samples used to compute the average composition were:

TABLE 2.—*Composition, coefficients of digestibility of nutrients, and digestible nutrient content of Napier grass leaves harvested in a manner to simulate grazing*

COMPOSITION OF FRESH GRASS

Source of Samples	Dry matter	Crude protein	Crude fiber	Nitrogen free extract	Crude fat	Ash	Total digestible nutrients
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Digestion trials ¹	20.8	2.7	6.0	9.4	0.9	1.8	-----
Grazing trials ²	21.4	2.8	6.5	9.8	0.7	1.6	-----

COEFFICIENTS OF DIGESTIBILITY

Steer:							
E 58.....	64.6	65.0	66.3	68.8	56.0	-----	-----
E 69.....	66.6	65.1	70.1	68.8	59.2	-----	-----
E 71.....	66.0	65.2	65.2	70.1	57.2	-----	-----
E 76.....	66.5	64.2	69.5	70.4	58.1	-----	-----
Average.....	66.0	65.0	68.0	70.0	58.0	-----	-----

DIGESTIBLE NUTRIENTS

Digestion trials ¹	-----	1.8	4.1	6.6	0.5	-----	13.7
Grazing trials ²	-----	1.8	4.4	6.9	.4	-----	14.0

¹ Digestion trial records are based on analyses of 21 samples taken Aug. 11 to 30, 1938.

² 23 samples of Napier grass represent 2 entire seasons for 1 area, and 1 season for a second area under rotational grazing; unpublished data used by permission of Blaser, Kirk, and Arnold.

Dry matter 16.5 to 24.0 percent, crude protein 9.9 to 17.5 percent, crude fiber 26.5 to 33.6 percent, crude fat 2.4 to 4.5 percent, and ash 6.0 to 8.4 percent. The ash content is less than half that of the values given in table 1. The average content of calcium, of magnesium, and of phosphorus were respectively, 0.50, 0.18, and 0.35 percent. The dry matter and protein content of the leaves is higher than reported by Wilsie, Akamine, and Takahashi (10), Paterson (8, 9), or Harrison (4), indicating that the materials are not altogether comparable.

Each of the four steers consumed approximately 15.5 pounds of dry matter daily, or about 75 pounds of fresh grass, which was sufficient to maintain their weight or to cause slight gains. The daily

feed intake and fecal output of the steers were quite uniform throughout the trial. The average digestion coefficients for the respective steers are presented in table 2.

The values for digestible nutrient content presented in table 2 were found by applying the digestion coefficients to the analyses in the same table. The fresh grass, having a dry matter content of 21.4 percent, averaged 1.8 percent digestible crude protein and 14.0 percent total digestible nutrients, or 8.5 and 65.7 percent respectively on a moisture-free basis.

The digestibility of fresh Napier grass and other comparable forages is presented in table 3. Napier grass leaves as grazed were more digestible than the whole plant as determined by Harrison but were not as digestible as mixed pastures grasses and clovers from closely grazed fertile pasture. However, they compared favorably with mixed immature grasses; were more digestible than bluegrass, redbtop or timothy, and much more digestible than the more mature Napier grass plant after ensiling.

TABLE 3.—*Digestion coefficients of the nutrients in Napier grass as compared with those in other pasture grasses reported by Morrison (6, Appendix, table 1)*¹

Forage	Number of trials	Crude protein	Crude Fiber	Nitrogen-free extract	Crude fat
Napier grass leaves ²	4	65	68	70	58
Napier grass ³	3	63	64	60	57
Native bluegrasses.....	2	64	45	60	50
Grasses, mixed, immature.....	2	70	66	75	62
Orchard grass.....	3	60	60	55	54
Pasture grasses and clovers, mixed, from closely-grazed, fertile pasture.....	51	77	76	78	56
Redtop.....	3	61	61	62	50
Sudan grass.....	4	72	76	69	72
Timothy.....	3	48	56	66	53

¹ Data used by permission of the author.

² From table 2 of this paper.

³ Harrison (4).

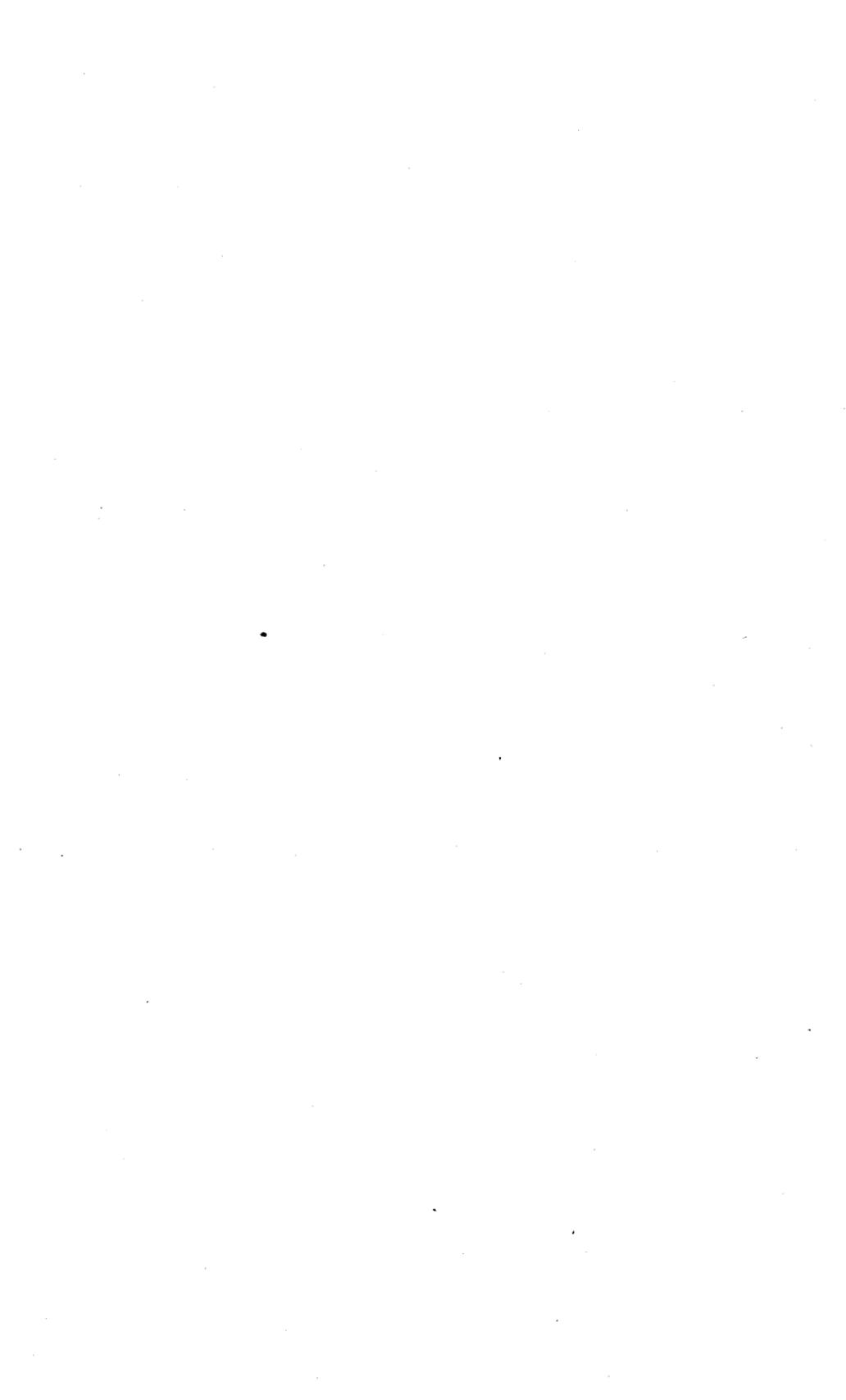
SUMMARY

Napier grass leaves as grazed rotationally by cattle provide pasture which is comparable in nutrient content with other pasture grasses. The digestion coefficients were found to be: For crude protein 65, for crude fiber 68, for nitrogen-free extract 70, and for crude fat 58, as compared with average coefficients of 63, 64, 60, and 57, respectively, as determined by Harrison. The fresh grass provided 1.8 percent of digestible crude protein and 14 percent of total digestible nutrients, or 8.5 and 65.7 percent respectively, on a moisture-free basis.

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